dti

PROJECT SUMMARY NO PS203

Harvester Development for New High Yielding SRC Crops and Markets

OBJECTIVES

- To develop harvester drive chain and feeding systems to cope with larger, modern, higher yielding crops.
- To assess, by harvesting sites of different ages of the most recently planted varieties, the most economic harvesting cycle for SRC crops. Focus on maximising machinery and crop output thus minimising delivered cost per tonne whilst still maximising grower return.
- To produce in one pass fuel that can be directly fired with coal in pulverised fuel systems.
- To produce in one pass large grade fuel suitable for gasification.
- To achieve a harvesting cost of ANY fuel specification of £10-£11/odt.

SUMMARY

The project has consisted of a number of engineering and field trials. Key amongst these has been development of robust harvester drive mechanisms that are able to withstand the larger crops that the UK now produces and the modification of the chipping system to allow different fuels specifications to be produced. Throughout a method of research into the specific area has been followed by engineering adaptations that have then been field tested and reviewed. Clearly with cost objectives, trials involving the assessment of cost of production through workrate and expense have been necessary and these have been incorporated. Finally consolidation of the knowledge and results gained has been made and incorporated in guidance notes and recommendations for further work.

Figure 1. Self-propelled forage harvester (courtesy of Coppice Resources Ltd)

CONTRACTOR

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COST

The total cost of this project was £108,997 with the Department of Trade and Industry (DTI) contributing £27,250 and CRL/Fred Walter & Sons Ltd the balance.

DURATION

12 months – October 2004 to October 2005

BACKGROUND

Short rotation coppice (SRC) is an under developed industry in the UK. Currently there are around 2,000 hectares (Ha) of crops planted many of which are not allocated to a specific end use. Large-scale markets have emerged mainly driven by co firing. For example, a single 2,000MW coal station, substituting 5% of coal with biomass, will have an annual demand of up to 300,000 oven dried tonnes (odts) or ~30,000 planted Ha of SRC. There are seven coal-fired UK power stations to date that have biomass handling facilities. To meet this potential demand, there is pressure on the capability of harvesting SRC to the market specification, at an economic price.

Latest information from crop breeders and field trials shows that a mix planted in the year 2000 compared to the late 1990s has a yield increase of 30%. The only way that the crop can achieve this is by growing more stems, and thicker, taller stems. Therefore, a SRC harvester has to be able to gather, feed, cut and chip this material.

There are also market sectors that have very different requirements for fuel specification. Trials work that CRL has been involved with to co-fire large coal-fired power stations has shown that the requirement is for particles of fuel that are 6mm x 3mm x 3mm in size. At the other end of the particle size scale, the gasification industry require a lump of wood that is 50-75mm long and as thick as the crop stem allows – i.e. retaining harvested stems whole as against splitting stems.

The goal of this project was to develop a harvesting system for SRC that can in one pass produce material to the required specification of an end user at a cost that enables the grower to be profitable and the end user to purchase fuel at a price that they can afford to pay.

CRL and mainstream machinery manufacturers, to meet the needs of the expanding willow harvesting and fuel market, will then aim to exploit the developed technology.

THE WORK PROGRAMME

1. Manufacture and installation of new components for large crop harvesting
2. Field tested on large SRC crops
3. Field Tested on crops of different ages
4. Installation and field test of hydraulic drive
5. Remanufacture and field test of chipping Drums
6. Economic assessment

Figure 2. Harvesting large SRC crops (courtesy of Coppice Resources Ltd)

CONCLUSIONS

- Harvesting of SRC crops using the technology developed as part of this project is technically robust
- Fuel specification can be altered to suit the requirements of different markets and can be produced economically
- In production of fuel for co-firing in large coal combustion plant using pulverised fuel there are a series of complex economics involving secondary processing and haulage that will dictate the most cost effective method of delivering product.
- As the scale of market grows the ability to harvest SRC over the majority of the year is essential to the economic viability of the crop as a fuel source in order to meet the desired tonnages of end users and to maintain a continual level of supply on a year round basis.
- Harvesting of crops that have grown beyond the normal scale is extremely costly (may be over three times the normal cost at £35/ODT) and not recommended.

POTENTIAL FOR FUTURE DEVELOPMENT

- Assessing the technical viability of harvesting all year round. Harvesting in summer months – July/August – has been described as having issues in sugar return to stools for re-growth and for biodiversity. This requires validation in commercial crop situations.
- Assessing the biomass fuel specification that can be co-fired in large coal plant – note as more experience is gained of the combustion properties (full burnout is required to avoid ash contamination) of SRC/biomass in coal fired systems the current limits on moisture and particle size may be extended.
- Modelling the economics of fuel supply to specific co-firing projects with regard to the balance between producing final fuel specification in the field, or reprocessing on/off site from larger SRC particles.
- Developing models of the co-firing market in relation to trends in ROC values, fossil fuel prices and the value of "captured carbon". This will help to develop understanding in the marketplace for growers/fuel suppliers in terms of price and demand thus ensuring that the supply industry is able to negotiate with large end users on a more equal footing.
- Long term work into embedded distributed generation will be vital to the industry following the end of the current co-firing period in 2016 and in reducing the economic impact of fuel costs on haulage of biomass fuels to end users.
- Assessing the haulage cost relationship with the specification of fuel produced. The different sizes of fuel produced will have different bulk densities and so the dry weight that can be carried in vehicles will vary and so the cost. In certain circumstances it may be more effective to chip initially at the most appropriate density for haulage and then to reprocess to the final specification for use.

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